

**Abstract**

The invention relates to a process for preparing butadiene from n-butane having the steps of

- A) providing a feed gas stream a comprising n-butane;
- B) feeding the feed gas stream a comprising n-butane into at least one first dehydrogenation zone and nonoxidatively catalytically dehydrogenating n-butane to obtain a product gas stream b comprising n-butane, 1-butene, 2-butene, butadiene, hydrogen, low-boiling secondary constituents and in some cases steam;
- C) feeding the product gas stream b of the nonoxidative catalytic dehydrogenation and an oxygenous gas into at least one second dehydrogenation zone and oxidatively dehydrogenating 1-butene and 2-butene to obtain a product gas stream c comprising n-butane, 2-butene, butadiene, hydrogen, low-boiling secondary constituents and steam, said product gas stream c having a higher content of butadiene than the product gas stream b;
- D) removing hydrogen, the low-boiling secondary constituents and steam to obtain a C<sub>4</sub> product gas stream d substantially consisting of n-butane, 2-butene and butadiene;
- E) separating the C<sub>4</sub> product gas stream d into a recycle stream e1 consisting substantially of n-butane and 2-butene and a stream e2 consisting substantially of butadiene by extractively distilling and recycling the stream e1 into the first dehydrogenation zone;
- F) if desired, feeding some or all of the stream e2 consisting substantially of butadiene into a selective hydrogenation zone and selectively hydrogenating butadiene to 1- and/or 2-butene to obtain a stream f comprising 1-butene and 2-butene;
- G) if desired, feeding the stream f comprising 1-butene and 2-butene into a distillation zone and removing a product of value stream g1 consisting substantially of 1-butene to leave a stream g2 comprising 2-butene;
- H) if desired, recycling the stream g2 comprising 2-butene into the first dehydrogenation zone.